

REMARKS

Claims 13-36 are pending in the application. By this Amendment, claims 1-12 are cancelled and claims 13-36 are added. Reconsideration and withdrawal of the rejections in view of the foregoing amendments and the following remarks is respectfully requested.

I. Formal Matters

The Office Action objects to the title as allegedly not descriptive. By this Amendment, the title is amended to read "METHOD OF MOUNTING ELECTRONIC COMPONENTS ON A PRINTED CIRCUIT BOARD." Accordingly, withdrawal of the objection is respectfully requested.

The Office Action also objects to the Abstract. Enclosed herewith is a Substitute Abstract. The Examiner is requested to replace the originally filed Abstract with the enclosed Substitute Abstract. Withdrawal of the objection to the Abstract is respectfully requested.

The Office Action rejected claims 7 and 12 under 35 U.S.C. §112, second paragraph. Because these claims have been cancelled, the rejection is moot.

II. The Drawings

A Request for Approval of Drawing Amendments is being filed herewith. In the Request for Approval of Drawing Amendments, Applicants propose to correct two typographical errors appearing in Figure 6a of the application. In addition, Applicants seek to remove an arrow line

which was inadvertently included within this drawing figure. Approval of these drawing corrections is respectfully requested.

III. The Restriction Requirement

The Office Action indicates that the June 4, 2002 Restriction Requirement has been made final and that claims 1-6 and 8-11 have been withdrawn from consideration. By this Amendment, the withdrawn claims have been cancelled.

IV. New Claims 13-36

By this Amendment, claims 13-36 have been added to the application. Claims 13, 21 and 28 are new independent claims directed to methods of mounting electrical components on a printed circuit board. Claims 14-20 depend from claim 13, claims 22-27 depend from claim 21, and claims 29-36 depend from claim 28. For at least the reasons discussed below, it is respectfully submitted that new claims 13-36 are allowable over the references of record.

The Office Action rejected claims 7 and 12 under 35 U.S.C. §103(a) over Togami (U.S. Patent No. 5,855,059), in view of Takahashi (U.S. Patent No. 5,084,962). It is respectfully submitted that new independent claims 13, 21 and 28 are all allowable over both of the cited references.

Togami discloses a surface mounting apparatus which includes two mounter head assemblies 26, 27. As shown in Figure 1, the two mounting head assemblies 26, 27 are mounted

on opposite sides of a carriage 19 such that the mounter heads can move in the X direction. The carriage 19 is itself mounted of two guide rails 21. The carriage assembly 19 can move in the Y direction along the two guide rails 21.

As shown in Figure 3, suction nozzles 35 are mounted beneath each of the mounter heads 26, 27. The suction nozzles 35 can pick up electrical components from two feeder mechanisms 17, 18. The suction nozzles can then place the electronic components onto a printed circuit board 16 which is held by a translational conveyor 36.

Togami explains that in operation, the translational conveyor 36 would first position the printed circuit board 16 to the right, as shown by the solid lines in Figure 3. At the same time, the carriage 19 would move to the left as also shown by the solid lines in Figure 3. This would allow suction nozzles 35 on the left-most mounter head 27 to pick up new electrical components from the feeder mechanism 18. At the same time, suction nozzles 35 on the right-most mounter head 26 could place electrical components on the printed circuit board 16. Next, the translational conveyor 36 would move to the left to the position shown by dashed lines in Figure 3. At the same time, the carriage 19 would move to the right as shown by the dashed lines in Figure 3. This would allow the electrical components held by the suction nozzles 35 on the left-most mounter head 27 to be placed onto the printed circuit board 16. At the same time, the right-most mounter head 26 can pick up new electrical components from the feeder mechanism 17. This process is repeated to mount a plurality of electrical components on the printed circuit board.

Applicants note that the suction nozzles 35 on each of the two mounter heads 26/27 are fixed with respect to each other, as shown in Figure 2. In other words, the suction nozzles 35 cannot move in either the X or Y directions with respect to each other. As a result, when the mounter head 26 is located over top of the printed circuit board, only a single electrical component can be mounted on the printed circuit board at any given moment in time. This means in a typical placing operation the following steps would be performed:

1. A first suction nozzle 35 on the mounter head 26 would place a first electrical component onto the printed circuit board 16.
2. The mounter head 26 would then move some predetermined amount in the X direction to position a second suction nozzle over the next mounting position on the PCB 16.
3. In addition, the translational conveyor 36 would probably move some distance in the Y direction to reposition the printed circuit board 16 underneath the second suction nozzle 35.
4. The second suction nozzle 35 holding a second electrical component would then place the second electrical component onto the printed circuit board 16.
5. This process would be repeated until each of the suction nozzles on the mounter head 26 have placed their respective electrical component onto the printed circuit board.

As explained above, with the configuration of the Togami surface mounting device, electrical components are mounted one-at-a-time on a printed circuit board. Both the printed circuit board and the mounter head must be repositioned after each electrical component has been mounted on the printed circuit board. This results in a relatively time consuming process to mount all electrical components onto the printed circuit board.

A. Claims 13-20

Claim 13 is directed to a method for surface mounting electrical components on printed circuit board. Claim 13 includes the steps of locating a PCB at a first mounting position by moving the PCB in both the X and Y directions within a working area of the surface mounter. This step of a method as recited in claim 13 is illustrated in Figures 3 and 5, which show that a printed circuit board could be moved in both X and Y directions to locate the printed circuit board at a mounting position at which it will receive electrical components.

As explained above, in the Togami device the printed circuit board 16 is only moved back and forth in the Y direction. During the mounting operations, when the printed circuit board is located in the working area, the printed circuit board never moves in the X direction. For at least these reasons, it is respectfully submitted that claim 13 is allowable. Claims 14-20 depend from claim 13 and are allowable for at least the same reasons, and for the additional features that they recite.

B. Claims 21-27

Claim 21 is also directed to a method for surface mounting electrical components on a printed circuit board. Claim 21 recites picking up a plurality of electrical components with a corresponding plurality of suction nozzles, and moving the plurality of suction nozzles with respect to the PCB, and with respect to each other, to substantially simultaneously mount a plurality of electrical components on the PCB.

As explained above, the Togami surface mounter is incapable of simultaneously mounting a plurality of electrical components onto a PCB. In addition, the Togami surface mounter cannot move individual suction nozzles with respect to each other. All suction nozzles on a mounting head are moved at the same time and in the same directions by the same amount. For at least these reasons, it is respectfully submitted that claim 21 is allowable. Claims 22-27 depend from claim 21 and are allowable for at least the same reasons and for the additional features they recite.

C. Claims 28-36

Claim 28 is also directed to a method for surface mounting electrical components on a printed circuit board. Claim 28 recites picking up a plurality of electrical components with a corresponding plurality of mouter heads, wherein the plurality of mouter heads are coupled to a corresponding plurality of Y-frames wherein the plurality of Y-frames are moveably mounted on a single X-frame such that the Y-frames are movable along the X-frame in the X

direction with respect to each other, and wherein the plurality of mounter heads are also moveable in the Y direction along their corresponding Y-frames. Picking up a plurality of electrical components with an arrangement as recited in claim 28 allows a surface mounter embodying the present invention to simultaneously mount a plurality of electrical components onto a PCB.

As explained above, the Togami surface mounter is incapable of picking up a plurality of electrical components with an arrangement of mounter heads as recited in claim 28. For this reason, the Togami mounter is also incapable of mounting a plurality of components onto a PCB substantially simultaneously. For at least these reasons, it is respectfully submitted that claim 28 is allowable. Claims 29-36 depend from claim 28 and are allowable for at least the same reasons, and for the additional features they recite.

In view of the foregoing, it is respectfully submitted that claims 13-36 are allowable over all of the references of record.

V. Conclusion

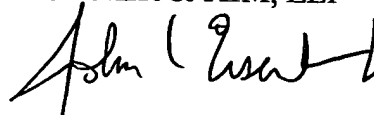
In view of the foregoing, it is respectfully submitted that the application is in condition for allowance. If the Examiner believes that any additional changes would place the application in better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number listed below.

Serial No. 09/586,797

Docket No. MRE-0028

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this, concurrent and future replies, including extension of time fees, to Deposit Account 16-0607 and please credit any excess fees to such deposit account.

Respectfully submitted,
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Enclosure:
Substitute Abstract

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ABSTRACT

A method of mounting electrical components on a printed circuit board includes moving the printed circuit board to a first mounting location, picking up a plurality of electrical components with a corresponding plurality of mounter heads, and then placing the electrical components onto the printed circuit board with the mounter heads. The mounter heads are arranged so that they can move with respect to each other in both the X and Y directions, which allows the mounting device to mount a plurality of electrical components onto the printed circuit board substantially simultaneously, thereby reducing the amount of time required to produce a finished PCB. In some embodiments of the invention, the printed circuit board may be moved from a first position at which a first mounting head mounts electrical components onto the printed circuit board to a second mounting position at which a second mounting head mounts electrical components on the printed circuit board. The first and second mounting positions may be located along the same conveyer, or on respective first and second conveyors, with the printed circuit board being moved back and forth between the conveyors.

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